

It is evident that India offers far greater advantages for investigating the variations of the solar heat than any European country can do, and as observations of the black-bulb thermometer *in vacuo* have now been registered at several stations during the last six or seven years, I have lately examined a portion of these, to see if they afford any direct evidence of a periodical graduated variation in the intensity of the radiation. The result is to me very striking, and if not absolutely conclusive as to the direct variation of the sun's heat with the number of the spots and prominences, certainly, as far as it goes, strongly confirms Mr. Baxendell's conclusions, drawn from indirect evidence.

It is unfortunate that owing to the fragility of the instruments employed and the necessity of exposing them freely, they are very frequently broken; and, as a consequence, the longest series of observations made with one and the same instrument extends over only five years. This is at Silchar in Eastern Bengal. The place is situated in lat. 25°, therefore beyond the tropic; and the climate being very damp and more cloudy than most parts of Bengal, it is not, perhaps, so favourably circumstanced for the present purpose as some other stations.

The means of the maximum sun-temperatures registered on clear days (that is, on days when the proportion of clear sky estimated at 10 A.M. and 4 P.M. did not average less than three-fifths) are given in the following table. The months of the S.W. monsoon are omitted, since in some cases they do not furnish a single clear day according to the above definition, and as a rule such days are too rare to contribute much evidence of value. I give for each month the number of clear days that have contributed to the mean.

TABLE I.—Average maximum temperature of solar radiation on clear days at Silchar.

	Days.	1870	Days.	1871	Days.	1872	Days.	1873	Days.	1874
January . .	24	124.8	25	127.1	27	122	21	121	19	121
February . .	19	130.4	20	130.9	20	125.8	19	128.2	8	128.2
March . . .	15	137.2	19	135.7	23	133.8	17	132.4	10	134.3
April . . .	12	142.6	17	139.1	13	140.5	12	134.5	5	139.8
May	10	144.7	15	142.8	14	143.8	5	140.6	6	146.5
October . .	16	140.7	19	136.7	9	141.3	7	140	5	146.4
November .	23	132.2	27	126.3	15	131.7	20	127.7	10	143.1
December .	29	124.7	25	121.3	18	121.5	23	121.2	14	136.7
Year . . .	148	134.6	167	132.5	139	132.5	124	130.7	77	137

Did this table stand alone, the evidence of any periodical variation would be very doubtful. But we shall presently see that the irregularities that it exhibits are all but completely neutralised by the registers of other stations. It is easy to suggest their explanation, grounded on the fact to which all the registers testify, that the highest sun-temperatures occur, not on days registered as cloudless, but on those on which there is a considerable proportion of cloud, and frequently rain. Such days were numerous in 1874; while in 1871 (the year of sun-spot maximum) days without visible cloud predominated. Leaving the discussion of this question, however, as unnecessary in this place, I will give the combined results of Silchar and eight other Observatories variously situated, some in, and others beyond the tropical zone. These are:—

Port Blair, in the Andamans	...	...	lat. 11° 41' N.
Cuttack, in Orissa	...	...	" 20 29 "
Chittagong, on the Arakan coast	...	...	" 21 39 "
Jessore, on the Gangetic delta	...	...	" 23 9 "
Dacca, also on the delta	...	...	" 23 43 "
Hazaribagh,* elev. 2,000 ft. in Western Bengal	...	...	" 24 0 "
Berhampore,* on the Gangetic delta	...	...	" 24 6 "
Roorkee, elev. 900 ft. in the N.W. Prov.	...	...	" 29 52 "

Since the radiation-thermometers originally in use at

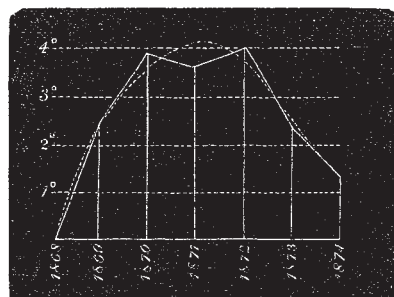
* The registers of these two stations taken alone give a curve nearly approximating to the resultant of all the stations, but it is of doubtful validity owing to the thermometers having been twice renewed at both stations.

most of these stations have been broken and replaced by other instruments, and since these thermometers (furnished by the best London makers) sometimes differ to the extent of many degrees when placed under the same conditions of exposure, it would be only misleading to compare together the registers of different years recorded with different instruments at the same station. In order to avoid this source of error, and at the same time to bring in evidence as much as possible of the registers, I have taken for each station separately the difference (rise or fall indicated respectively by + and -) of each pair of homonymous months in consecutive years, omitting all cases in which the instrument has been changed in the interval; and then the mean of all the differences thus obtained for the same pair of months. The results are given in the following table, additional columns being added to show how many stations have contributed to the mean of each pair of months. As in Table I, the mean temperatures compared are those of clear days only; but with the exception of Port Blair, I have admitted as clear days those only on which at least four-fifths of the sky on an average was estimated as unclouded at 10 A.M. and 4 P.M. In the case of Port Blair it was necessary to admit days with only one half of unclouded sky.*

TABLE II.—Annual variation of mean maximum readings of black-bulb thermometers on clear days.

	Station.	1868	Station.	1869	Station.	1870	Station.	1871	Station.	1872	Station.	1873	Station.	1874
January . .	2	- 0.9	3	+ 0.5	4	+ 0.4	6	- 3.7	4	+ 0.4	8	- 5.3		
February . .	2	+ 1.9	3	- 1.5	4	+ 0.6	6	- 3.6	4	+ 2.1	8	- 3.6		
March . . .	2	+ 3.8	3	+ 1.2	4	+ 2.6	6	- 2.4	5	- 0.7	8	- 1.7		
April . . .	2	+ 7.1	3	+ 1.5	7	- 0.5	5	+ 0.7	5	- 0.6	8	- 2.5		
May	1	+ 14.2	3	+ 0.9	7	- 1.9	4	+ 2.6	7	- 4.7	8	+ 2.7		
October . .	2	- 4.3	3	+ 8.2	6	- 1.5	4	+ 0.6	4	+ 3.5	8	- 3.6		
November .	3	- 2.7	4	+ 0.4	6	- 1.3	4	+ 2.2	8	- 2.9	8	+ 0.8		
December .	3	- 1.0	4	+ 1.8	6	- 0.3	4	+ 0.4	-	-	-	-		
Year . . .		+ 2.3		+ 1.6		- 0.3		+ 0.4		- 1.6		- 1.1		

If these differences be plotted as the increments of a series of ordinates, and the curve thus marked out be corrected for its small irregularities *liberâ manu*, its resemblance in general character to the sun-spot curve will be distinctly apparent. (See figure.)



I have been unable to ascertain (here in Calcutta) the number of spots observed during the last few years; but this datum can readily be supplied at home.

Calcutta, May 28

HENRY F. BLANFORD

LECTURES AT THE ZOOLOGICAL GARDENS†

VIII.

Mr. Sclater on the Pheasants.

IN that Birds possess a high temperature of the blood, they agree more with the mammalian than with other vertebrate animals; the balance of anatomical evidence

* I have ascertained by direct comparison that any difference thus introduced is inappreciable, the results being treated comparatively, and not for absolute values.

† Continued from p. 129.